HTIRC03-004

1. A method to form an embedded micro-pedestal in a conductive layer, having a first top surface, comprising:

depositing on said top surface a layer of sputter resistant insulating material;

forming a first stripe-shaped photoresist mask on said insulating layer and then etching all exposed portions of said insulating layer thereby forming a preliminary hard mask;

removing said first photoresist mask and then forming, on said top surface and preliminary hard mask, a second stripe-shaped photoresist mask, that is orthogonally and symmetrically disposed relative to said preliminary hard mask, and then selectively etching all exposed portions of said insulating layer thereby forming a final hard mask;

by means of ion milling, removing an amount of the layer wherever said first top surface is exposed, thereby forming said micro-pedestal and a second top surface;

then, through electroless deposition, selectively depositing a layer of embedding material on said second top surface and on all sidewalls of said micro-pedestal; and

removing said final hard mask.

2. The method described in claim 1 wherein said embedding material has a resistivity between about 1 and 5 milliohm cm.

3. The method described in claim 1 wherein said layer of insulating material is selected from the group consisting of alumina, silica, silicon nitride, and aluminum nitride.

4. The method described in claim 1 wherein said layer of insulating material is deposited to a thickness between about 150 and 1,000 Angstroms.

5. The method described in claim 1 wherein said first stripe-shaped mask has a width between about 0.05 and 0.3 microns.

6. The method described in claim 1 wherein said second stripe-shaped mask has a width between about 0.05 and 0.3 microns.

7. The method described in claim 1 wherein micro-pedestal has a height between about 200 and 500 Angstroms.

8. The method described in claim 1 wherein said embedding material is selected from the group consisting of NiReB, NiReP, and NiReBP.

9. The method described in claim 1 wherein the step of selectively depositing said layer of embedding material on said second top surface and on all sidewalls of said micro-pedestal further comprises using a solution containing nickel sulfate, 0.05 to 0.2 moles per liter, dimethylamine borane, 0.01 to 0.05 moles per liter, sodium hypophosphite, 0.01 to 0.05 moles per liter, sodium citrate, 0.1 to 0.5 moles per liter, ammonium perrhenate, up to 0.05 moles per liter, and lead nitrate, up to 10 ppm, at a bath temperature of 50 to 90°C

and a pH level of 6 to 7 for 1 to 6 seconds.

10. A process to manufacture a CPP GMR read head, comprising:

providing a bottom conductor layer and depositing thereon, in succession, a pinning layer, a pinned layer, a non-magnetic spacer layer, and a free layer, thereby forming a GMR stack having a top surface;

depositing on said top surface a sputter resistant first layer of insulating material;

forming a first stripe-shaped photoresist mask on said insulating layer and then etching all exposed portions of said insulating layer thereby forming a preliminary hard mask;

removing said first photoresist mask and then forming, on said top surface and preliminary hard mask, a second stripe-shaped photoresist mask, that is orthogonally and symmetrically disposed relative to said preliminary hard mask, and then selectively etching all exposed portions of said insulating layer thereby forming a final hard mask;

by means of ion milling, etching down to the level of said non-magnetic spacer layer wherever said first top surface is exposed, thereby forming a CPP GMR pillar having sidewalls;

selectively depositing onto said non-magnetic spacer layer and sidewalls an embedding layer of a material, whose resistivity is between about 1 and 5 milliohm cm, until said embedding layer has a top surface that is coplanar with the top surface of said CPP GMR pillar;

then selectively removing said final hard mask;

then forming a liftoff mask that is symmetrically disposed to cover said CPP GMR pillar and a portion of said embedding layer that symmetrically extends a distance away from said CPP GMR pillar;

then depositing a second insulating layer and then lifting off said liftoff mask, thereby exposing said CPP GMR pillar top surface; and

depositing a top conductive layer thereby forming said CPP read head.

11. The process described in claim 10 wherein said second insulating layer is selected from the group consisting of NiReB, NiReP, and NiReBP.

12. The process described in claim 10 wherein said second insulating layer is deposited to a thickness between about 200 and 500 Angstroms.

13. The process described in claim 10 wherein said pinned layer is a single layer of soft magnetic material.

14. The process described in claim 10 wherein said pinned layer is a synthetic antiferromagnetic laminate.

15. The process described in claim 10 wherein said first layer of insulating material is

selected from the group consisting of alumina, silica, silicon nitride, and aluminum nitride.

16. The process described in claim 10 wherein said first layer of insulating material is deposited to a thickness between about 150 and 1,000 Angstroms.

17. The process described in claim 10 wherein said preliminary hard mask has a width between about 0.05 and 0.3 microns.

18. The process described in claim 10 wherein the distance from said CPP GMR pillar for which said embedded layer extends is between about 0.01 and 0.05 microns.

19. The process described in claim 10 wherein CPP GMR pillar has a height between about 200 and 500 Angstroms.

20. The process described in claim 10 wherein said embedding layer is selected from the group consisting of NiReB, NiReP, and NiReBP.

21. The process described in claim 10 wherein the step of selectively depositing said layer of embedding material on said bottom conductive layer and sidewalls further comprises using a solution containing nickel sulfate, 0.05 to 0.2 moles per liter, dimethylamine borane, 0.01 to 0.05 moles per liter, sodium hypophosphite, 0.01 to 0.05

moles per liter, sodium citrate, 0.1 to 0.5 moles per liter, ammonium perrhenate, up to 0.05 moles per liter, and lead nitrate, up to 10 ppm, at a bath temperature of 50 to 90°C and a pH level of 6 to 7 for 1 to 6 seconds.

22. A process to manufacture a CPP GMR read head, having current concentrated in its signal producing layers, comprising:

providing a bottom conductor layer and depositing thereon, in succession, a pinning layer, a pinned layer, a non-magnetic spacer layer, and a free layer, thereby forming a GMR stack having a top surface;

depositing on said top surface a sputter resistant first layer of insulating material;

forming a first stripe-shaped photoresist mask on said insulating layer and then etching all exposed portions of said insulating layer thereby forming a preliminary hard mask;

removing said first photoresist mask and then forming, on said top surface and preliminary hard mask, a second stripe-shaped photoresist mask, that is orthogonally and symmetrically disposed relative to said preliminary hard mask, and then selectively etching all exposed portions of said insulating layer thereby forming a final hard mask;

by means of ion milling, etching down to the level of said pinning layer wherever said first top surface is exposed, thereby forming a CPP GMR pillar having sidewalls;

selectively depositing onto said pinning layer and sidewalls an embedding layer of a material, whose resistivity is between about 1 and 5 milliohm cm, until said embedding

layer has a top surface that is coplanar with the top surface of said CPP GMR pillar;

then selectively removing said final hard mask;

then forming a liftoff mask that is symmetrically disposed to cover said CPP GMR pillar and a portion of said embedding layer that symmetrically extends a distance away from said CPP GMR pillar;

then etching down to the level of said first conductive layer all material not covered by said liftoff mask;

then depositing a second insulating layer and then lifting off said liftoff mask, thereby exposing said CPP GMR pillar top surface; and

depositing a top conductive layer thereby forming said CPP read head.

23. The process described in claim 22 wherein said first layer of insulating material is selected from the group consisting of alumina, silica, silicon nitride, and aluminum nitride.

24. The process described in claim 22 wherein said first layer of insulating material is deposited to a thickness between about 150 and 1,000 microns.

25. The process described in claim 22 wherein said preliminary hard mask has a width between about 0.05 and 0.3 microns.

26. The process described in claim 22 wherein the distance from said CPP GMR pillar

for which said embedded layer extends is between about 0.01 and 0.05 microns.

27. The process described in claim 22 wherein CPP GMR pillar has a resistance between about 1 and 10 ohms.

28. The process described in claim 22 wherein said embedding layer is selected from the group consisting of NiReB, NiReP, and NiReBP.

29. The process described in claim 22 wherein the step of selectively depositing said layer of embedding material on said bottom conductive layer and sidewalls further comprises using a solution containing nickel sulfate, 0.05 to 0.2 moles per liter, dimethylamine borane, 0.01 to 0.05 moles per liter, sodium hypophosphite, 0.01 to 0.05 moles per liter, sodium citrate, 0.1 to 0.5 moles per liter, ammonium perrhenate, up to 0.05 moles per liter, and lead nitrate, up to 10 ppm, at a bath temperature of 50 to 90°C and a pH level of 6 to 7 for 1 to 6 seconds.

30. The process described in claim 22 wherein between about 99 and 99.9 % of current through said read head passes through said CPP GMR pillar.